Bangalore Metropolitan Transport Corporation
Central Offices, Bangalore

Mechanical Engineering Dept.

(With effect from Jan-2024)

Tender No. ---------- Dated: 08.02.2024

Specification for Type-I Fully Built City bus on 5537 mm (218”) to 5639 mm (222”) wheel base chassis fitted with Engine conforming to BS-VI Emission Norm (AIS-052 as amended from time to time, AIS-140 and AIS-153) GI Tubular structure & Stainless Steel, GI and Aluminum paneling.

A) CHASSIS:

IMPORTANT:

1) Complete set of Type Approval Certificate (TAC) with Annexure-II having the details of Chassis Dimensions, Aggregates as per Table-7 of AIS-007 applicable for model / specific variants offered by the Tender should be uploaded along with other documents of Pre-qualification. If the same is runs into hundreds of pages, Certificate part can be uploaded as a pre-qualification criteria and complete set of Hard Copies along with Annexures shall be invariably submitted with other documents.
2) The fully built bus shall be as per requirements of AIS-052, AIS-140, AIS-135 and AIS-153 standards.

Sl. No.	Particulars	Specification		Conformity Yes or No
1	Dimensions of Chassis (Single Deck) in mm.	Particulars	Requirement	
		Wheel base	5537 mm (218”) to 5639 mm (222”)	
		Height of the Chassis	1000 mm ± 50mm when measured at the middle of Wheel Base.	
		Front Overhang & Rear Overhang	Front overhang should be accommodating front door of size 864mm clear aperture ahead of front axle, FOH should be minimum of 32% of wheelbase. Rear overhang not exceeding 60% of the Wheelbase of the chassis.	
2	Chassis	a) The Full forward control, ladder type passenger chassis without cowl conforming to latest revision of KMVR and CMVR in all respects. b) Chassis shall comprise of chassis frame, front Engine compliant to BS-VI norms, CRDI, High pressure pump, Air compressor, Radiator, Transmission (including Clutch, Gear box and Propeller shafts), Front Weveller and Rear air		

		Suspension, Rear Axle Assembly, Power Steering Assembly, Seven Wheels with Tyre Assembly, Brake System, 24 V Heavy Duty Wiper Assembly to be provided along with fully build bus, Head and Tail Lamp Assemblies, Two electrical Horns of Roots make or equivalent make, Side Indicators, Aesthetically designed Instrument panel and Ergonomically designed adjustable type PVC type knitted type driver seat assembly as per AIS-023 of FISA type confirming to IS-15061 with 3 point safety belt and a capacity of 15 Ton telescopic type hydraulic jack. c) Proper foundation provision should be provided in the chassis for construction of Drivers Cabin Structure. d) Engine bonnet assembly should be made out of M.S/ FRP for easy maintenance by Operation and Maintenance staff around the engine area. e) Fire retardant heat insulation to be provided and the insulation shall prevent heat radiation into Driver cabin. f) Provision to be made for proper air circulation to carry heat dissipated by the engine. g) Engine bonnet should be slightly elevated at bottom/ podest type with some of its portion towards dashboard fixed and remaining hinged portion covered and openable. h) Front end structure (without cowl), Front & Rear bumper to be provided along with fully built bus. Rugged Tow hooks should be provided at front of the chassis. i) The height of the chassis to be same from front end to rear end. The allowance for variation in straightness (Bend) of Chassis Frame is Maximum 5mm. j) The height of the dashboard frame should be at a lower level, for clear visibility of the driver.	

3	Engine	a) The front mounted internal combustion engine shall be four stroke of HINO /CUMMINS/ EICHER make or equivalent, six cylinder, compression ignition, that runs on high speed diesel oil equipped with common rail direct injection high pressure pump and controlled by ECU's, conforming to BS-VI emission standard. b) Drive type engine and its accessories (air compressor, power steering pump) should be gear driven. c) Engine emission reduction shall be conforming to BS-VI emission norms. d) Engine should perform smoothly without encountering complaints such as Engine over heat, Low pick up, Engine connecting sound, etc., e) Good quality oil inspection gauge with socket and gauge should be easily accessible. f) Engine oil sump shall be provided with magnetic ended drain plug and sufficient cooling room should be provided to avoid thickening of engine oil. g) Engine oil drain interval should be minimum 80000 kms.	
	Power	Minimum- 130 KW to 150 KW Torque- 550 Nm to 750 Nm	
4	Air intake system	a) Dry type, double filtered air cleaner shall be horizontally mounted underneath the driver seat floor for easy maintenance / OEM design. b) The system shall have air leakage and filter choke up indicator mechanism, on Dash board for easy observation by O&M staff.	
5	Fuel Injection System	CRDI high pressure pump suitable for BS-VI Engine with suitable governing devices conforming to latest technology.	
6	Lubrication	All Lubricating points shall be properly located, easily accessible for lubricating with pneumatic operated equipment.	
7	Cooling System	The system shall include DAT Radiator with pressure resistant radiator cap clamped with chain conveniently mounted for easy topping up of coolant. Water Pump and Viscous Fan/ Viscotronic fan of adequate capacity with thermostat to control the coolant temperature.	
8	Emission system of BS-VI chassis (E.A.T.S)	The Engine shall meet BS-VI emission norms. A Photo copy of the test certificate issued under CMVR 126 by the Competent Authority shall be submitted along with the tender. The Exhaust Gas After Treatment System (EATS), a) should be covered under warranty period up to 5 years.	

		b) EATS incorporated in the BS-VI bus model supplied to BMTC should meet city bus applications/ conditions, especially suitable for BMTC operational model. c) OEM should provide proper provision for easy top-up/ checking/ maintenance of the After Treatment System components, free from any external obstacles and should safely equip the system components with a strong covering securing from external impacts. d) The system should be located securely with convenient ground clearance to avoid damage and impact during operations and also prevent water logging. e) EATS should have proper durable insulation, so as to prevent heat radiation to its surrounding components.	
9	Transmission Clutch & Pressure plate	a) Single plate, dry type, mechanical clutch with pneumatic/ hydraulic assistance. b) Pressure plate of diaphragm/ finger type has to be provided. c) Proper locking mechanism between clutch fork and C.R bearing to be provided.	
10	Gear Box	a) The Gearbox shall be of Manual Transmission, Synchromesh type with minimum five forward and one reverse gear of ZF make or equivalent suitably designed for operation on all terrain in city areas. b) The gearbox should be provided with magnetic ended drain plug and breather. c) The gear shifting pattern should be similar to that of previously supplied bus model to BMTC. d) Gear lever position should be located properly, so that is suitable for switching of gears (front & reverse) easily by drivers.	
11	Propeller shaft assembly	a) The Propeller shafts should be provided at front, middle and rear mounting to the underneath chassis with suitable CJ brackets, couplings and CJ yokes. b) Dana spicer make or equivalent propeller shaft assemblies, Greasable / Lube For Life (LFL) CJ cross kit, CJ bearing and CJ yokes with propeller shafts be provided for transmission system. c) The mounting brackets provided for propeller shaft should be strong enough to withstand longitudinal/ transverse vibrations, shocks exerted during rotation of shafts and shall be durable up to 15 years.	
12	Front Axle	a) The Front Axle shall be of I-beam type Reverse Elliot design made of Forged Alloy Steel conforming to CMVR.	

		b) The Kingpin and its bushes shall be easily repairable without removing I-beam from the vehicle.	
13	Rear Axle	a) Fully floating single reduction Hypoid gear type. b) Sunken magnetic ended drain plug and breather should be provided.	
14	Tyres & Wheel Discs	a) 10.00X20–16PR–Radial Tyres-7 Nos. with tube type only of rib tread pattern, of reputed make be provided. b) Wheel Discs shall be of Wheels India make or equivalent having slots sufficient for easy inflation of tyres, especially at rear wheels. c) The Inner tyres at rear shall be provided with tube extensions. d) The Wheel Rims shall meet IS-10694. e) All the vehicles supplied under the tender shall have Wheel discs of same kind and of single manufacturer.	
15	Steering	a) Steering system shall be engine gear driven, Rane/ ZF make or equivalent. b) The steering position shall be as per the Manufacturer design. c) The power assisted steering system shall be sufficiently rugged in design to withstand peak road shocks without risk of component failure or alteration of steering geometry. d) The steering column alignment should be comfortable to Drivers and shall be adjustable. e) Steering reservoir should be transparent type having upper and lower limit of oil and should be located at suitable place for easy maintenance and proper opening to be provided in top most area of Dashboard for easy top-up, after bus body building. Reservoir cap should be clamped with chain or plastic cord. f) Steering system shall be of single manufacturer.	
16	Suspension	Front both LHS and RHS be provided with Weveller Suspension and Rear both LHS and RHS be provided with Air Suspension system of Wheels India make or equivalent and shall have double acting telescopic type shock absorbers at all wheels.	
17	Brakes	a) Dual line Air Brake system be provided, with drum type brakes with asbestos free/ organic type liners on all four wheels with Automatic Slack Adjuster of reputed manufacturer. b) The brake unit assembly (Brake carrier plate, Brake Shoe, Brake Liners, Brake shoe retainer spring, Rollers, S-cam shaft, Brake Drum and Auto Slack Adjuster) at all wheels shall be provided with superior quality. c) Graduated type hand control valve shall be	

		provided as per manufacturer design (which shall be easily accessible to Driver) mounted on floor, with Hand Brake system operating with actuators on rear wheels. d) D.D unit, Automatic Slack Adjuster, Relay valve and other necessary valves be provided for proper functioning of front & rear brake or as per manufacturer design. e) Anti-lock Braking systems to be provided of single manufacturer.	
18	Fuel & AdBlue Tank	a) The fuel tank (Metallic only) shall conform to the specification of SAE 703 with a storage capacity of maximum 185 Litres. b) Fuel tank should be provided with locking system and should be mounted with three brackets. c) The AD blue tank, if provided should have filling capacity of maximum capacity of 60 ltrs and also top-up level indication on the tank be provided.	
19	Electrical System	a) Two Batteries of 12 Volts each with minimum 165 AH capacity of reputed manufacturer. b) One Mechanically/ Electrical Hand Operated battery isolation switch shall be provided in battery box. c) The universal Electrical cut-off switch (button operated) shall be located on the dashboard. d) The battery cable should be of fire retardant as per IS-2465 and IS-6722 and of suitable length, so that the terminals shall face the battery box lid and easily retractable for maintenance of Batteries, after Bus body construction.	
20	Alternator & Self Starter	a) Starter and Alternator of capacity suitable for proper functioning of electrical system shall be provided. b) Both these units shall be located at such a place, so as to prevent ingress of oil or rainwater into them. c) Self Starter & Alternator shall be of Lucas make or equivalent make. The assemblies to be facilitated for easy maintenance. d) OEM should support technology with supply of child spare parts up to 15 yrs.	
21	Instrument panel	a) Aesthetically designed Instrument Panel should consists of Speedo Meter with km counter, Air pressure Gauge, Flashing-Side indicator and switch, Warning lamp/ buzzer for low air pressure, charging of batteries, Starter switch, Dipper switch, Battery indicator displaying volts / Voltmeter / Ammeter, Temperature gauge, Engine oil pressure gauge / low oil pressure warning lamp, Urea level gauge, %age soot accumulation indication, Engine RPM Meter of tamper proof type	

		and temperature alert (buzzer). Real time KMPL shall also be displayed. Indication of Suit to be provided, Battery voltage to be displayed. b) The instrument panel should be dust proof, free from ingress of water and the acrylic material of the instrument panel to be scratch resistant. c) Warranty to be provided for Instrument Cluster Unit up to 5 years.	
22	Fire Detection and Alarm System (FDAS)	Fire Detection and Alarm System (FDAS) be provided in accordance with AIS:135 & AIS-153.	
23	Service Life	The chassis shall be designed for a service life of 15 years or 9.0 lakh kilometers, whichever is earlier.	
24	Warranty	a) The unconditional warranty for "Chassis, Assemblies/ Sub-assemblies such as Air intake system, Engine assembly, HPP, Radiator, Intercooler, Water Pump, Fuel system & its components, Turbocharger, Air compressor, Clutch system & its components, Gearbox & its components, Starter, Alternator, Propeller Shaft assy., Front Axle assembly, Rear Axle assembly, Brake system & its components, Pneumatic system & its components, Steering system & its components, Air Suspension system & its components, all Electrical components (ECU's, Control Units, Sensors, Wiring harness, Wiper) and Bus Body & its components", will be for 2.50 lakh kms or 3 years, whichever is later, from date of commissioning of the vehicle. b) Batteries should be covered under a warranty period of 2 years from date of commissioning of the vehicle, adhering to the supply as per 14 (r) under SECTION IV: SPECIAL CONDITIONS OF CONTRACT (SCC). c) Tyres should perform up to Non-Skid depth on the basis of normal & wear tear, from the date of commissioning of the vehicle, adhering to the supply as per 14 (s) under SECTION IV: SPECIAL CONDITIONS OF CONTRACT (SCC). d) E.A.T.S should be covered under warranty period up to 5 years from the date of commissioning of the vehicle, as described at sl.no.8. e) L.E.D destination boards and Voice Announcement System should be covered under a comprehensive warranty of 10 years. f) Instrument Cluster should be covered under warranty period up to 5 years from the date of commissioning of the vehicle, as described at	

		sl.no.21. g) Camera and mNVR should be covered under a warranty period of 5 years from date of commissioning of the vehicle. h) Vehicle Location Tracking and Panic Button should be covered under a warranty period of 5 years from date of commissioning of the vehicle.	
25	General requirements	The chassis shall be compatible for fitment of following items : a) L.E.D destination Board as per IS 16490:2016 b) Provisions for CCTV to be provided. c) Automotive Tracking Device and Integrated system as per IS 16833:2018 (Annexure-A) d) ITS –Requirement for Public Transport Vehicle Operation (AIS-140). e) FDAS to be provided.	
26	Vehicle Location Tracking (VLT) with Emergency Panic Buttons As per AIS-140	Requirement of VLT and Panic Buttons as per AIS-140 and as described at main point G.	

B) <u>General Conditions:</u>

A. <u>For regular supplies</u>:

1) All the aggregates shall conform to latest regulations and manufacturer shall be same for entire tendered quantity of buses.
2) Each fully built bus should be supplied with CMVR related certificates and tool kit consisting of suitable box spanner, tommy bar, hydraulic jack, tyre lever, 4 stoppers, triangular reflectors etc.
3) Certificate of compliance as required by the Transport Commissioner/relevant authority.
4) For every 20 fully built bus operator’s manual be provided.
5) For each fully built bus specification card consisting of make, model/ type capacity along with part numbers and with maintenance schedule for all spares and assemblies be supplied.
6) For every fifty fully built bus, hard and soft copy of the workshop manual be supplied consisting of principle of operation, maintenance to carry out, Dimension of the components involved, Fitment &

Removal procedures of components, tools to be used, precautionary measures, etc..

7) For every fifty chassis spare parts catalogue be supplied.
8) 20 no's of tech tool installed with necessary software along with complete set of connecting cable, adapters, etc., for diagnosis, trouble shooting and rectification of fault code or defect for the type of bus be supplied by successful bidder for maintenance purpose on free of cost basis along with user manual. Lifetime upgradation / renewal of software or Tech tool is to be done by successful bidder on free of cost basis with life time validity. The said tools shall be supplied before completion of delivery of the supply of last bus out of the ordered quantity failing which the last bus will not be accepted by purchaser.
9) An authenticated (Hard & Soft Copy) fault code statement also to be provided consisting of necessary details such as fault code no., description, reason for appearance, ways to resolve the fault code, etc.

B. Technical aspects to be compliant to :

1) Battery main cable and all electrical cables should be routed properly (tagging/ clamping/ insulating, etc.), should not pass beside any heating components (Turbocharger, Exhaust manifold, etc.) to avoid rubbing, peeling of outer skin of cables, sagging of cables, etc. The concealment of all electrical cables/ conduiting each wiring modules with a separate color coding for easy identification of wiring harness/ modules separately with an opening/ chamber facility at certain intervals.
2) All pneumatic hose pipes should be properly clamped to avoid sagging and rubbing against other parts, especially the conducting of the Front & Center door pneumatic hose pipes.
3) Provision should be made for easy top-up of Engine oil, P.S. oil, Clutch oil and Radiator, without any obstacles.
4) Proper provision for carrying out easy maintenance of all assemblies to be facilitated, i.e., easy removal and fitment, without any obstacles.

5) ECU, CBCU, Fuse box, Battery cut-off switch etc., should be placed at appropriate location without any obstacles for easy maintenance of the said components and other spares & assemblies.

6) Air Filter should be at suitable location for carrying out easy replacements and should be free from any obstacles (near pneumatic doors, etc.).

C. Documents to be furnished during prototype bus inspection:

1) The Tender documents shall include one copy of operator's manual, specification card and workshop manual for all the models offered in the tender.
2) Publication of specifications for each model offered in the tender.
3) Manufacturer's chassis drawing including large scale drawings for use of bus body builders.
4) Periodicity for replacement of all types of lubricants along with recommended specification and filters with part numbers.
5) List of Authorized dealers.
6) Enlarged drawing showing front end, steering, engine units etc.,

D. Other Terms and conditions:

1) OEM should furnish a comparison chart showing the differences between the earlier supplied and about to supply bus model listing all the modifications/ technology differences made in the spares/ sub-assemblies/ assemblies for having better knowledge and to perform effective maintenance (Before / After Tender) at the time of prototype delivery.
2) An authenticated copy on periodicity for replacement of all types of lubricants & filters are to be provided along with necessary specifications of the bus model.
3) An authenticated copy on the specification including make, model/ type, capacity along with part no's to be provided for all spares, sub-assemblies/ assemblies of the bus model.
4) OEM should provide detailed technical specification consisting of physical/ chemical properties for lubricants recommended.

5) OEM is responsible for all the premature failures/ defects noticed in a fully built vehicle, irrespective of supplier/ body builder, for which OEM has to take necessary rectification measures.
6) OEM (Service Representative) has to take necessary action to attend the defect, soon after receiving the information over Email or Phone or Letter.
7) OEM has to setup a dedicated representative to exclusively address the BMTC issues/ complaints along with a procedure for the BMTC (Zone/ Depot) personnel to convey the complaints and for sending/ receiving/ status on the vehicle from OEM/ its authorized dealers.
8) The OEM/ its authorized dealer has to attend the major defect, minor defect and repeated defect within the stipulated time period–after receiving the vehicle. If it crosses the stipulated time period, each day thereafter will attract penalty to levy on the OEM.
9) OEM should furnish a monthly report consisting of defect attended details (veh. no., date & time, no. of times the vehicle attended for same defect, Depot, etc.,) by their designated authorized dealers.
10) Theoretical and practical training to be imparted continuously till all the technical aspects of a bus is covered to all the technical personnel and Drivers on the driving habits at the depots in which the supplied buses are under operation.
11) OEM shall abide by to facilitate/ should ensure the availability of fitted Assembly/ Sub-Assembly/ Spares from the OES for the buses supplied.
12) OEM has to furnish the list of authorized dealers who are authenticated to attend the complaints noticed in BMTC buses.

E. Pre-delivery Inspection:

The Chassis should be washed with kerosene and then water. All the lubricants and filters should be changed and all greasing nipples should be greased properly.

C) BUS BODY :

IMPORTANT : 1) Construction of Bus Body shall be as per AIS-052 Bus Body Code.

2) Design specified in the Specification is of indicative. Any changes in concept design indicated in the Specifications based on the AIS-052 certification could be considered with due approval of CME, BMTC. Successful Tenderer or their Authorized Body Builder shall obtain AIS-052 Certification for the respective

<table>
<tr><th>Sl No.</th><th>Particulars</th><th>Specification</th><th>Conformity
Yes / No, if Yes Specify</th></tr>
<tr><td>1</td><td>BUS BODY CONSTRUCTION – GENERAL DATA</td><td>The construction of caged structure should be with cold rolled GI Rectangular / Square tubular sections with limited quantity of M.S. Rolled and formed sections adopting MIG welding technology. All M.S. Rolled and formed sections should be chemically treated adopting latest technology conforming to Indian standard specification. All welded joints should be neatly ground and painted after applying Epoxy primer solution and be provided with rust prevention and salt resistant protective coating. After welding, grinding and alignment, entire structure be applied with anticorrosive Epoxy paint.</td><td></td></tr>
<tr><td>2</td><td>DIMENSIONS</td><td>Shall be as per manufacturers design conforming to AIS-052.

Center to Center distance between side pillars and stump pillars below waist rail level should be 737 mm and center to center distance between main pillars should be 1474 mm as shown in the drawing.
<table>
<tr><th>Description</th><th>Dimensions</th></tr>
<tr><td>Wheel base</td><td>5537 mm (218”) to 5639 mm (222”)</td></tr>
<tr><td>Exterior body width</td><td>Not exceeding 2600mm</td></tr>
<tr><td>R.O.H.</td><td>Not exceeding 60% of wheel base</td></tr>
<tr><td>Interior height at structure Stage</td><td>As per drawing</td></tr>
<tr><td>Total Body length</td><td>As per drawing</td></tr>
<tr><td>Seating capacity</td><td>Minimum 41+1 DR</td></tr>
</table></td><td></td></tr>
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3	**FFLOOR STRUCTURE**	a) Minimum 14 Nos. of M.S. Rolled Channel of size 50x100x50x5mm and 2490 mm length be laid on the chassis longitudinal as Body Main Cross Bearers. Cross Bearers adjacent to middle wider door shall be made as box type as shown in the Drawing. Except at doors pillar level and at rear axle level, collars of all main cross bearers shall face backwards. One No. of rear-end Cross bearer of MS Rolled Channel 50x 100 x 50x 5 mm of 2340 mm long placed at rear end of the chassis for mounting of rear end structure. Collar of this channel shall face frontwards**.** 2 Nos. of MS Rolled Channels 50 x 100 x 50 x5 mm placed along chassis frames lengthwise on both side of chassis connecting corresponding (rear axle housing) H section channels. These Cross Bearers be of M.S. Rolled “C” Channels conforming to IS-1079: 1988 of a reputed make. MS rolled angles of size 40x40x6mm be provided for mounting of mudguards on the floor. b) The ends of Rear axle “H” formation Channels be welded to the respective Main Cross Bearers in such a way that these does not come in contact with the rear axle air suspension assembly, tyres etc., while the vehicle is in operation. The top level of the “H” formation should match to top surface of the corresponding Main Cross Bearers. The floor Longitudinal joining the Cross Bearers should be of M.S. formed ‘C’ section of size 25 x 125 x 25 x 2.00 mm in one row for fitment of floor joining, stanchions and 2 rows of Floor longitudinal of MS formed ‘C’ section 25x75x25x2.5mm for 2 seater assemblies leg fitment as shown in the	

		drawing. Two rows of M.S. Formed angle of size 37x37x3mm be provided each in between seat mounting section and sole rail as shown in the drawing. The floor longitudinal used should be arranged in such a way that each seat leg is fixed on the floor longitudinal. The collar portion of the floor longitudinal be facing downwards. Joints of floor longitudinal be provided with M.S. triangular type Box Gussets of size 75 x 75 x 25 x 2.50mm on opposite sides.	
4	**BODY MOUNTING:**	a) The Cross Bearers be mounted on the chassis without drilling any holes on the Chassis long members. M.S. Base Plates of size minimum 100x150x6mm be welded to these Rolled M.S. Channels (Cross Bearers) at the bottom. Diagonal holes of 5/8" (16mm) Dia. be drilled for these base plates for fitment of "U" Bolts. In between Chassis longitudinal and Base Plates, 12mm thickness Balata Packing in single piece be provided. M.S. End Plates of size 75 x 125 x 6mm thickness be fully welded on both ends of channels for mounting of Main and Stump pillars. b) M.S. High Tensile Galvanized "U " bolts of size 5/8" Dia. (16mm) be used to fasten the Floor structure to the Chassis with heavy-duty self-locking nylock nuts. The "U" Bolts should not project more than ¼" above the nylock nuts when fully tightened. Specification and drawings of "U" Bolt is enclosed. Necessary Aluminium Die-cast packing and Tubular Inter-postings be provided while tightening the U Bolts. The Tubular interposts be provided inside the Chassis web with the U bolts to avoid over	

		tightening of U bolts.	
5	**DRIVER'S CABIN STRUCTURE AND FLOORING:**	a) Original Driver's cabin floor supplied along with the Chassis be retained. b) The Driver's cabin floor structure be adequately supported at the front with original cabin foundation in such a way that its load is not carried by the Bulkhead but carried by the chassis frame. c) The main support structure to the Driver's cabin floor is of M.S. Rolled "C" Channel of size 50x100x50x5mm. The rear end of the Channel be welded to the Bulkhead channel with angular cleats & box gussets and connected to the original foundation member/ brackets provided by the Chassis manufacturer and extended up to front end structure. d) The remaining floor structure be fabricated with 37x37x3mm M.S. rolled "L" Angle and M.S. flats of 38 x 6.00 mm, which should be welded to respective structure including the mudguard support structure. Right round Gear box lid and behind bonnet assembly M.S. Rolled angle of size 40x40x6mm be provided. Main and stump pillars at cabin LH side be connected to the foundation channel with GI ERW tube of 50 x 40 x 2 mm. The Driver`s cabin flooring be laid with a 14 SWG thickness M.S sheet be welded to the floor structure at required places. Over MS Sheet Aluminium chequered sheet of 3.15mm be laid fastened with 6mm bolts and nuts / Aluminium solid rivets. e) An opening in the Driver's cabin floor be provided for the gear-box and its lid be hinged to the floor structure with budget lock. The gear	

		box lid be as that of driver flooring.	
6	**SIDE STRUCTURE:**	a) The position of main and stump pillars of side structure should be as per drawing. The main pillars, stump pillars be of GI rectangular section of size 60 x 40 x 3mm be mounted vertically with Cross Bearer in full length from cant rail to skirt rail. Main pillars / window pillars above the waist rail level up to cantrail bottom level be also for 60 x 40 x 3mm GI Rectangular tubes, Top and bottom ends of Window pillars shall be opened on both sides for 130mm radius. Opened portion of the window pillars shall be provided with MS Gussets of 3mm thickness duly stitch welded with the tubes. In the front overhang the front door of size 864mm clear aperture ahead of front axle with effective width of front door shall be minimum 650mm. The clear aperture for middle door is 1414mm and the effective width of the door shall be minimum 1200mm. Effective width means the clear width between the two hand holds. Entrance door pillars be of combination of two pillars of 60 x40 x 3mm placed adjacent to each other Center-to-Center distance between side main and stump pillars be 737 mm below waist rail level except at Battery Box and above waist rail 1474 mm as shown in the drawing. The side structure contour be maintained as per drawing. b) M.S. flats of size 30 x 6mm be provided as reinforcement to the side pillar and door pillar for mounting of grip handles, assistance rails, grab rails, door hinges, window frames etc., 35 x 3mm flats for fitment of window frames. c) The **waist rail** GI tubular section of size 80 x 40 x 3mm be welded horizontally along the vehicle	

		at a height of 650 mm measured from the top level of the Cross Bearer to top level of waist rail. Box type M.S. gussets of size 20 x 50 x 2 mm be welded at bottom corners of waist rail with stump pillars and Triangle shape reinforcement plates of size 125 x 125 x 3 mm be provided at joint of main pillar / window pillars to waist rail at inside saloon. d) One row of GI tubular section of size 50x40x2mm welded between side pillars as **center panel rail.** Above the wheel arches and door aperture 60x40x3mm GI tubes be provided as shown in the drawing. e) Above the wheel arches, GI tubular section of size 60 x 40 x 3mm be fully welded from wheel arch bay to front end and at rear wheel arch bays. f) **Anti drumming** cum truss of G.I. tube section of size 40 x 40 x2 mm be provided diagonally between waist rail and center panel. One row of 40 x 40 x 2 mm GI Square tube be provided in between sole rail and skirt rail. g) The **sole rail** should be M.S. rolled “L” angle of size 37x37x3mm. The sole rail be mounted on top of the cross bearers on the corner edge of the side pillars right round, it should be welded fully with the side pillars and cross bearers. h) The **seat rail** M.S. rolled “L” angle of size 37x37x3mm thickness be welded to the side structure at a height of 292mm from the Cross Bearer top level for fixing the Seat legs. i) The **cant rail** be of CRMS GI tube of size 80 x 40 x 3 mm. The cant rail be mounted on top of the side pillars and fully welded. Cant rail shall be mounted on window pillars such that joint of	

		cant rail shall not be above the middle wider door. j) The **skirt rail** be of GI ERW tube of size 40 x 20 x 2mm be welded to the side pillars bottom at Battery box remaining skirt rails shall be of M.S. formed angle of size 20x40x2.00 mm. k) Right round Driver and Emergency doors formed GI "Z" section of size 25x10x25x1.60 mm be stitch welded for fitment of car beading. l) Provide suitable cut out provisions for Diesel tank, Urea tank, Battery box and Air filter for easy maintenance as shown in the drawing. Weld the side frames with floor structure end plates. Box type gussets be provided for sturdiness of the structure.	
7	**ROOF STRUCTURE**	a) GI tube, square tube **roof sticks** of size 40x40x2mm thickness, contoured to body be provided on each main pillars and in between the bay as shown in the drawing. Height of the roof sticks from center to front and center to rear be lowered by progressively as shown in the drawing. The roof sticks be mounted on the Cant rail and fully welded with formed M.S. "L" angle cleats and 50 x 50 x 2mm triangular gussets on both sides of outer surface. The curvature of the roof sticks be well finished and there should not be any wrinkles. b) Join the roof sticks, with 5 rows of **roof longitudinal** made out of GI formed top hat sections of size 25 x 38 x 38 x 38 x 25 x 1.6mm thickness and 2 rows of GI formed Z sections of size 20 x 40 x 20 x 1.6mm thickness be provided in each bay. Longitudinal be welded to the respective roof sticks with M.S. Gussets of size 50 x 50 x 2.00mm. Web of middle longitudinal	

		be provided with 40 x 6mm M.S. Flats for fitment of Stanchions. c) All doors top apertures and apertures behind entrance doors be provided with 1.6 mm thick GI Sheets connecting respective roof sticks and roof longitudinal be provided as shown in the drawing. d) For mounting of roof hatches 40x40x2mm GI tube with necessary reinforcements be provided.	
8	**FRONT AND REAR END STRUCTURE:**	**A) FRONT END STRUCTURE:** The original FES be adequately supported at the front and sides in such a way that its load is not carried by the bulkhead but is carried by the chassis frame. The front corner windscreen pillar, Cantrail and Waist rail of the front-end structure be of GI tubular section of size 60 x 40 x 2mm, remaining vertical and horizontal members be of 40 x 40 x 2mm GI tubular section. The front windscreen pillars be provided with rectangular insert M.S. Tube to the full height of the pillars. Windscreen frame made out of M.S. Rolled angle of size 25 x 25 x 3mm and 35 x 35 x 3mm be welded to the wind screen pillar, Waist rail & Cant rail with M.S. flat reinforcement for fixing front wind -shield glass. Structural joints below waist rail level be provided with MS Box type gussets of size 20 x 50 x 20 x 2.5mm. and M.S. Cleats of size 35 x 35 x 3mm. M.S. Rolled angle of size 38 x 38 x 3mm be provided at cowl / Bumper bottom level. Outriggers and sections provided in the chassis front end structure be retained; its side verticals be made as box type and welded to the side structure. Driver side original flooring be connected to the side structure with 37 x 37 x	

		3mm M.S. angles. **Strengthening of Front end:** Longitudinal members of chassis are extended towards front about 25” beyond the Cabin foundation. Extended portion be utilized for strengthening of front end structure as mentioned below: Two vertical supports of M.S. rolled “C” channels of size 75 x40 x 5mm be provided on both sides of the chassis longitudinal, from bottom of longitudinal to top level of the dash board by bolting to the chassis original holes. The location of Channels should be in such way that, passage for easy removal / fitment of engine and radiator should not be restricted. Vertical tubes of front - end structure be connected to these channels. These vertical Channels be connected to windshield pillar by Outrigger made out of M.S. Rolled angle of size 50 x 50 x 6mm. **REAR END STRUCTURE:** The rear end structure be fabricated by using GI tubular section of size 40 x 40 x 2mm, 40 x 20 x 2mm tubes and M.S. Flats of 40 x 6mm. M.S. Formed “C” section of size 25 x 125 x 25 x 2 mm be provided at bottom as rear bumper.	
9	**WHEEL ARCH:**	Half hexagonal / Half round wheel arch frame for both front and rear wheels be fabricated by M.S. rolled angle of size 37 x 37 x 3mm thickness with M.S. flats of size 38 x 3mm. The front and rear wheel arches be mounted and welded with a minimum height of 250mm measured from the top level of the tyre.	
10	**MUDGUARDS**:	The front and rear mudguards frames be covered by using 10 SWG Aluminum chequered sheet. Over the mudguards wearing strips be provided in	

		2 rows. Mudguard wings be of 18 SWG GI sheet; provided with angular support with side structure.	
11	**MUDGUARD FLAPS:**	The rubberized mud flaps be provided of good quality standard size to the width of the mudguard. The flap be fitted to the mudguard with Aluminium flat beading fastening with bolt and nuts.	
12	**FOOT STEP ASSEMBLY:**	Front and middle main entrance cum exit with three raised type step well be provided on LH side as shown in the Drawing. Step well should suit the JK door. The step well assembly structure be fabricated by using 37 x 37 x 3.00 mm M.S. rolled angles and 40x 75 x 40 x 6.00 mm M.S. Rolled channel. Rolled angle of size 37 x 37 x 3.00 mm be provided diagonally between footstep horizontal Rolled channel to the Channel bolted to the chassis as outrigger. MS gussets be provided for the structure. Step well tread portion be provided by covered by 10 SWG aluminum chequered sheet of 3.15 mm thick. The steps raised portion and step-well truss portions be covered with 0.8mm thickness stainless steel sheet. Step-edge Aluminum extrusions and 2 rows wearing strips be provided for steps.	
13	**BATTERY BOX , DIESEL TANK LID AND UREA TANK LID :**	Battery Box be provided behind LH front wheel and below the flooring using the space between chassis frame and body skirt. The battery box size be minimum 24” x 25” clear in width and depth to accommodate 2 batteries. The length of the cables from battery to the main cable cutoff switch be in one length and without any joints. The frame be fabricated by using MS formed angles of size 37 x 37 x 3.00mm. The frame sides be covered with 18 SWG Aluminum/stainless steel	

		and bottom 10 SWG aluminium chequered sheet rivetted to the respective structure rigidly. The battery cable cutout be provided with 6 mm thick Balata packing having "X" cross cutout at center/rubber grove-met. The box be made dust proof by applying P.U. sealant at the joints. Battery box lid be fabricated by using 14 SWG Aluminium sheet of hinged type. The SS hinges should be of 40 x 40 x 2mm width Volvo type/ piano type having 12mm pitch with stainless steel rod. Budget lock be provided to the lid. Aluminum grip handle of 3" length be provided for the lid. The batteries be kept on the Battery Box platform with 20mm thick good quality wood. One holding clamp made out of MS flat of size 38x3mm with 6mm thick balata packing be provided. Suitable frame work be provided in the side structure just above the fuel tank neck for fueling the vehicles; spring loaded flap (flush type) made out of 14 SWG Aluminum sheet with press lock/ budget lock be provided. Urea tank lid be made out of 14 SWG Aluminum sheet with press lock / budget lock be provided.	
14	**SPARE WHEEL CARRIER:**	The original Spare wheel carrier supplied by the chassis manufacturer be retained/ to be removed will be decided during the bus body construction.	
15	**DOORS:**	**a) PASSENGER DOOR**: Power operated service as per AIS-052 be capable of moving only when the doors are closed. Jack Knife design passenger doors will be fitted for the front and centre doors of bus body. The frames be fabricated with CRMS tube of 50 x 20 x 2.00 mm for outer main frame, also inside be stitched welded with CRMS tube of size 15 x 15 x	

		2.00 mm to the outer surface of the main frame. Behind the inner tube clear toughened flat safety glass of 5.00 mm thickness be pasted with black PU sealant of metal to glass. This rubber profiles-flap rubber, male and female rubber extrusion be provided of EPDM quality. The flap rubbers be placed in the aluminum grove channels. The door shall be provided with independent pneumatic cylinder mechanism with sensor enabling to control the movements of door from the driver seat. One pneumatic cylinder for single door and two pneumatic cylinders for the centre door. The entire system shall be ensured for trouble free operation. Grab rail of 25.00 OD x 2.00 mm of 1.00 mtr length be provided diagonally for both front and centre doors for easy climbing up of the steps. Stoppers to be provided between doors for easy operation. MS three hinges of reputed make be provided with easy operation out of three hinges one foldable hinge-cum-handle be provided at the centre. The complete door frame be powder coated with black colour. Floor mounted pneumatic cylinder be provided for each set of door for easy operation. Back pressure sensor for passenger safety be provided. Emergency switches be provided outside and inside of the bus on the body sheet. MS ‘L’ bracket be fitted on the top of the door along with replaceable type nylon bush. The door assembly shall swing suitably and should not rub with the footstep. Proper care be taken to ensure no ingression of water and dust. Three signages of ‘X’ type red colour stickers be provided on the door. Pre relief valve should be provided for manual operation of door with	

suitable instructions inscribed on the outer and inner panel. The finishing work be done neatly with elegant aesthetic.

b) DRIVER DOOR :

Hinged type door be provided for the Driver on the RH side. The door frame be fabricated out of G.I. tube of 2mm thickness and 2 Nos. forged Hinges with reinforcement. Heavyduty spring loaded lock of reputed make be provided with chromium plated handle and cup for inside and outside operation. One No. 150mm Aluminium handle at door inside be provided. The door interior be paneled with 0.8 mm thickness Stainless steel sheet with Metal to Metal PU sealant and Star screws. The external paneling of the door be done with 18 SWG Aluminium sheet. The window frame be as that of side window frame and clear toughened glasses of 5 mm thickness with black powder coated Aluminium catches be provided. Door be provided with one latch lock and one 150mm steel tower bolt. The door be made perfectly dustproof. Three way door dovetails and brass striker plate be provided. Elegant pee cap made out of 18 swg aluminium sheet be provided above the door. Right round door bay ambassador dust proofing rubber be provided. Three numbers of Sunken type foot steps be provided in the skirt panel below the Driver door. The maximum height of first step from ground shall be 550mm and the height of other steps be of max 250mm. The minimum step width and depth be 150mm.

Delight bay be made as that of window frame type. The glass be made sliding vertically up and

		down movement with necessary catches and locks. **c) EMERGENCY DOOR**: Emergency door be provided utilizing the bay behind rear axle on RH side from Solerail to window rail as shown in the Drawing. The door frame be fabricated out of G.I. tube of 2mm thickness and 2 Nos. forged Hinges with reinforcement. Heavy duty spring loaded lock of a reputed make be provided with chromium plated handle for inside. One No. 150 Aluminium handle at door inside be provided. The door interior be paneled with 0.8 mm thickness Stainless steel sheet with Metal to Metal PU sealant and Star screws. The external paneling of the door be done with 18 SWG Aluminium sheet. The window frame be as that of side window frame and clear toughened glasses of 5 mm thickness with black powder coated Aluminium catches be provided. Door be provided with one latch lock and one 150mm steel tower bolt. The door be made perfectly dustproof. Three way door dovetails and striker plate be provided. Elegant pee cap made out of 18 swg Aluminium sheet be provided above the door. 2 No. of Sunken type foot steps be provided in the skirt panel below the Emergency door and one 150mm grip handle be provided for door pillar towards saloon. Right round door bay ambassador dust proofing rubber be provided.	
16	**LED DESTINATION BOARDS:**	4 numbers electronic based L.E.D display boards at front, rear, LH side and interior along with next stop voice announcing system having GPS based receiver/antenna and speakers be provided. The specifications of the L.E.D board is enclosed. The	

		approval of L.E.D boards & Voice Announcement System be obtained from CME before fitment. Necessary reinforcement be provided for proper fitment. The L.E.D destination boards shall be part of the structure to avoid sharp edges from the passenger safety point of view.	
17	**DASH BOARD AND INSTRUMENT PANEL:**	The dashboard be extended and connected to the front-end structure. The dashboard be fabricated with 37 x 37 x 3mm rolled MS angles and 35 x 6mm MS flats to the full width of the body and up-to front end structure. The original height of the dashboard be retained. The Dash Board be paneled with elegant FRP suitable to the cluster unit and the dash board be applied with Silver gray Hammertone paint. Original Instrumental panel be retained. Dashboard truss panel be provided with 0.8mm thickness stainless steel sheet; maintenance cutout with lid fitted with piano hinges and 75mm steel tower bolt be provided for Power Steering oil container and Coolant tank. Dashboard vertical panel in front of foot pedal be provided with perforated M.S. Sheet.	
18	**GRAB RAILS**	a) Three no's of entrance rails for center door and one no for front door be provided at floor level with MS ERW pipes of size 38mm OD x 2.00mm thickness to the full height of the bus. Also the horizontal and diagonal support pipes of size 25mm OD x 2mm thickness be provided to the vertical pipes. The complete assembly be rigidly fixed to roof and side structure with reinforcements. b) Two rows of powder coated grab rails be provided on either side of the gang way with MS ERW pipes of size 25 OD x 2.00mm thickness and rigidly fitted with sockets to stanchion poles. Eleven nos of stanchion poles MS ERW pipes of	

		size 38 OD x 2.00mm thickness be provided in the saloon portion and rigidly fitted with reinforcement at the top and bottom (6 nos – RHS, 5 nos- LHS). Proper care should be taken by locating the pipes avoiding obstruction in between seats. c) One powder coated Bonnet barricade cum grab rail made out of M.S. ERW tube of size 32 OD x 2.00 mm with 6 mm thick M.S. end plates be provided from dash board to driver's partition with 5/16" Dia. HT GI Bolts. d) Colour shade of powder coating of stanchions, grab rails, entrance rail, bonnet barricade, driver partition pipes be got approved by CME.	
19	**DRIVER'S CABIN PARTITION:**	The partition be provided to the 1/3rd interior width of the body. The main vertical member be of M.S. ERW pipes of size 38 OD x 2mm with M.S. end plates of 6mm thickness. M.S. ERW pipes of size 32 ODx2mm with M.S. end plate of 6mm thickness be provided horizontally at waist rail and window rail level. In between these two pipes, 5 Nos. of M.S. ERW pipes of size 25 OD x 2mm. be provided vertically at equidistance. The complete frame be powder coated before fitment. For fastening of this frame, reinforcement of 6mm thick M.S. Plates be provided at roof structure, Window rail and Waist rail level.	
20	**BONNET ASSEMBLY:**	Original bonnet assembly supplied along with Chassis be retained. The outer surface of bonnet be applied with Hammertone gray paint. Gear lever cutout rubber should be of good quality. Bonnet assembly will be supplied along with fully built bus and approval is to be obtained from CME.	
21	**FASTENERS :**	a) For fastening sub-structure like Driver's partition, grab rails, assistance rails, window frames etc., M.S. reinforcements be provided in	

		the body structure. b) All bolts and nuts be of Galvanized high tensile steel conform to IS-1367, IS-1364 with (BSF threads); self lock- nuts be used. c) All the joints at the structure stage be properly notched and matched with the rest of the main structural components to ensure perfect plain surface. d) The joints be fully welded to ensure proper alignment of the structure before taking-up for paneling work. All welded joints should be neatly ground and applied with Epoxy solution. e) After completion of structure work in all respect, entire structure be applied with anticorrosive Epoxy paint.	
22	**PASSENGER SALOON FLOORING:**	a) The passenger saloon flooring be laid with aluminum chequered sheet thickness of 10 SWG. The aluminum chequered sheet be fastened with MS solid rivets to the floor structure at a pitch of 2” in Zig- Zag manner in the joints and at a pitch of 10” on cross bearers. b) The saloon flooring be laid and fastened to make the flooring entirely dust proof with U rubber beading at sole rail right round. Aluminium step-edge extrusion be provided on the edges of mudguard humps. c) The saloon flooring be laid and fastened to make the flooring entirely dust proof with U rubber beading. d) In the gangway 7 rows of aluminum wearing strips with half round head screws and at edges also in between half round head bolts be fastened. e) To drain water 4nos. of drain plugs in floor area and 2 nos. on footstep be provided. Inspection lids with locks be provided in the saloon flooring	

		for the maintenance of gear box, rear air suspension etc.	
23	**EXTERNAL SIDE PANELLING:**	a) The exterior body paneling from waist rail to skirt rail be provided with Non Magnetic LN-1 stainless steel sheet of 1.00mm thickness in single length and firmly pasted with metal to metal PU sealant of reputed make and approved quality to structure. The quality of workmanship to be ensured to give good finishing and wrinkle free while forming and stretching the sheet. Trueness of surface be maintained. Suitable cut out shall be provided at the mudguard and finished with EPDM wheel arch rubber beading. For diesel tank, urea tank and air filter cut-outs, suitable lids be provided for easy operation. b) The rear end corner and top doom portion be paneled with 18SWG aluminum sheet. c) The rear portion below rear wind screen glass and above bumpers be provided with half hard 14swg Aluminum sheet. d) All door tops portion should be provided elegantly designed canopy made of aluminum sheet to avoid entry of water. Provisions be made out of 18SWG aluminum sheet for fitment of tail lamps.	
24	**EXTERIOR ROOF PANELING:**	a) Exterior roof paneling be done with 18 SWG Aluminum Sheets. Thermocool of 40 mm thick be provided in between roof exterior and interior panels. The roof exterior panels be in lengthwise of the vehicle in three rows. The side panels be semi-round type above cant rail level. The overlap of center panel should come over the side panels. The overlap joints be applied with reputed make leak proof PU sealant and riveted	

		with 3/16" Dia. Aluminium NR5 solid rivets at a pitch of 100mm zigzag with roof longitudinal hat-section. At cant rail level the roof panel sheet be formed in J shape as water channel and fastened with flat beading be riveted with 3/16" Dia and covered with Volvo type beading. Aluminium NR5 solid rivets at a pitch of 75mm. Utmost care be taken while riveting roof panels to avoid seepage of water. b) Before interior roof paneling work, roof exterior panel be checked for water leakage. c) External roof front and rear dooms be paneled with 18SWG Aluminium Sheets. d) Exterior roof panel be covered with Bitumen impregnated Hessain water proofing tar-felt of minimum 2 mm thickness of reputed Make covering a width of 1780mm and for full length. This tar-felt be pasted with Tar-plastic roofing compound manufactured by reputed Make.	
25	**INTERIOR PANELING:**	In between exterior and interior roof panels 40 mm thick Thermocol be provided. The interior roof be paneled with pre coated 18 SWG Aluminium Sheets. The panels be widthwise and panels be applied with metal to metal sealant and joints be provided 25x3mm aluminium flat / sleeve beading and 3/16" Dia. Aluminium Pop rivets at a pitch of 100mm. In between the exterior side panel and truss panel thermo-cool of 40mm thickness be provided. Truss panel be provided with 0.80 mm thickness Stainless Steel Sheets. Vertical joints of panels be provided with 25x3mm Aluminium flat beading. Top edge of truss panel SS sheet be made "J" at waist rail level and "L" type at sole rail level. Truss Panel sheet be provided with Metal to Metal	

		PU sealant and fastened with Star screws at Side pillars. Window pillar finishers and Louver pillar finishers be of 0.80 mm thickness Stainless Steel Sheets provided with Metal to Metal PU sealant and fastened with star screws. Colour shade of interior roof sheet be got approved from CME.	
26	**WINDOW FRAME AND GLASSES:**	**1) WINDOW FRAME:** a) The side windows shall be of unit construction so that the whole window frame assembly along with louver glass can be easily fixed on to the body by using EPDM rubber glazing without lock rubber by wire drawing method. b) The window frame should be black powder coated. c) Aluminium extrusion 'E' section of latest design be used with inner flocked rubber channel with terene. The frame be fitted so as to cover the respective pillars. d) The window frame at bottom be provided with slot holes to drain-out water. **2) WINDOW AND LOUVER GLASSES:** a) Good quality and approved clear toughened float flat glasses of 5.00mm thickness be provided to the windows. b) Both the sliding glasses be provided with black powder coated Aluminium window locks with Machine Screws for easy movement. c) The over lapping of glasses be minimum 50mm. d) For both glasses, Aluminium "H" extrusion with EPDM sweep rubber be provided as dust and water- proof. e) Good quality approved clear toughened float louver glasses of 5.00mm thickness	
27	**FRONT AND REAR WIND SHIELD PAN AND GLASSES:**	a) The front windscreen pan be made of unit construction and the pan be fabricated out of 18 SWG Aluminium sheet with M.S. rolled angle 25 x 25 x 3mm at top & sides and 35 x 35 x 3mm at bottom as main frame. Laminated toughened (triplex) front glass be of reputed make in single piece of A-A quality cured profile bend type of 8.76+/-0.3 mm thickness conforming to IS: 2553. b) The glass be fixed in good quality EPDM rubber	

		glazing of size 2” with a minimum inclination as per AIS 052. c) Rear windshield glasses be of toughened clear float glass of 5.00mm thickness fitted to the window pan by using 1” EPDM rubber glazing.	
28	PAINTING:	a) 2-K PU High Solid Base Metallic paint and clear paints for exterior Body. b) Dry sand the SS sheet surface with P120 emery paper and Aluminium sheet, FRP with P220 sanding sheet. c) Degrease the surface using wet & Dry cloth method with anti -static degreaser. d) Apply 2-K PU putty on bare metal wherever necessary so as to correct the minor defects of leveling in the metal sheet. Putty should be applied first in thin coat holding the putty blade at 90degree angle. Subsequent coats can be applied in thick coats. Mixing ratio of the putty is 100:2 (2% hardener). Dry sanding or wet sanding be done after 30 minutes of putty application. e) Sanding of putty should be done with P 80 wet or dry sheets and subsequently with P150/180 and final with P220 Ensure that a fine feather edging is achieved. f) Degrease with degreaser or silicon remover, and spray zinc rich 2K P.U. Primer in one single coat. g) Drying time / curing time is 45 minutes. h) Topcoat the primed surface with 2-K PU High solid primer surfacer. i) Mixing ratio: 4 parts of 2-K High solid P.U. surfacer and one part of H.S Hardner. Two coats to be applied with 10 % 2-K acrylic thinner to achieve a even film thickness of 100 microns. Apply the surfacer with a 1.8/2.0 nozzle spray gun. j) Wet or dry sand the surfacer after 8 hours of drying at an ambient room temperature of 25 degrees with P600 and final with P 800 wet or dry sanding sheet. Before painting, ensure that the surface is again degreased with anti static degreaser and cleaned by using a tack cloth to remove fine dust particles on the surface. k) 2-K PU High Solid Base Metallic paint (Optional): Mix the High solid base Metallic P.U. paint in the	

		ratio of 2:1 (2 part of paint and one part of thinner) with 2-K Acrylic thinner. Spray the paint on the bus body with a 1.40 nozzle gun from a distance of 6 to 8 inches from the bus body at a regulated pressure of 45 psi. in two coats. Allow a flash off 20 minutes between each coat. l) As soon as the H.S. P.U. paint is touch dry Top Coat with High Solid P.U. Clear in two coats in the following mixing ratio (2-part P.U. clear with one part of slow hardener. Add with 10% M.S. acrylic thinner), to achieve a film thickness of at least 50 to 55 microns to ensure prevention of ultra violet rays penetration and ensure longevity of the paint. m) Drying time after spray is 8 hours at room temperature. n) After completion of painting to the body, apply clear coat to the complete body. o) The painting processes be done as prescribed by paint manufacturer. p) Dry film thickness of 110 microns and glossy level should be 90 units at 60 degree angle. q) The warranty of paint be for 2 years for peeling off / fading. r) Lettering, Monogram, Battery box, urear tank, diesel tank, air filter tank etc., should be done by using reputed make reflecting stickers of as per our choice and design. s) The approval of design and shade of the paint be obtained from CME(P) before painting.	
29	PASSENGER SEATS:	a) As per CMVR AIS 023, 2 x 2 high back with cushion seats should be mounted as per drawing. Specification and drawings of Passenger seat assembly are enclosed. Seats should be mounted as per drawing. b) The mounting of Passenger seats should be of forward facing. Total saloon seating capacity be minimum 41+1 DR as per drawings. The specifications of the passenger seats is enclosed. c) Passenger seat bottom/ back rest cover stitching shall be double stitched. d) Passenger seat back/ bottom rest and head rest	

		rexine shall be covered under warranty of 2.5 lakh kms or 3 years.	
30	DRIVER SEAT:	The driver seat with safety belt supplied along with the chassis be retained and near the foot pedals foot rest be provided.	
31	ALUMINIUM EXTRUSIONS:	After completing the internal paneling, the following Aluminium extrusions be provided. a) Aluminium extruded step edges strips be provided to the edges of step-well, dashboard edge and mudguard hood edges. b) Aluminium extruded wearing strips for Gangway in 7 rows, above Mudguards, Floor area in front of foremost seats and at cabin floor area. c) Aluminium extruded sleeve beading for interior roof joints. d) Aluminium extruded flat beading for interior truss panel vertical joints. e) Aluminium extruded water channel at cant rail level. f) Aluminium extruded rubber locking beadings for the entrance doors.	
32	FRONT COWL CUM BUMPER:	a) The front cowl cum bumper be fabricated with 18 SWG GI sheet. b) The cowl assembly shall have provision for fitment of Headlamps and Indicators. c) The cowl should have least air drag effect. Side doom radius be minimum 300mm. d) Joints of the cowl be perfectly welded. e) Engine access door / Grill be of FRP with perforated sheet. f) The grill be mounted with gas spring and Pivot at both sides of grill. One stopper be provided for the grill.	

33	WIRING AND LIGHTING:	a) The wiring be done with 4mm, 6mm and 8mm L.T. cables. Only reputed make cables are be used having tinned conductors annealed copper and as per BSS No. 1952 or the latest specification or L.T. cable conforming to ISS 2465:1984 of size commensurate with the estimated current loading. b) The wiring be done at suitable place, keeping in view of easy maintenance. The wiring be provided with plastic sheathing / PVC flex pipe. The wiring be invariably laid just above cant rail level. Wherever any of the wire passes through a hole in a panel or sheet of metallic components, a rubber grommet of suitable size shall be provided for protection of insulation. c) Highly reliable separate electric switches be provided alternate roof lamp assembly. d) Two nos. original side indicators lights be provided in the front cowl. e) Original headlamps 2 Nos. supplied along with the chassis be retained. f) Original tail lamp assemblies supplied along with the chassis be fitted at rear end. g) Four numbers of width cum side indicator lights of moderate size and of attractive type with AMBER colour glasses be provided below cant rail level on the sides of the vehicle (Two numbers in the front and two Nos. in the rear). h) Reputed make Retro reflective tapes of red at rear, White at front and Yellow at sides of 50mm width as per CMVR rules be provided. i) Provision be made for charging the Electronic Ticketing Machine (ETM) near driver partition with box and lock. j) The buses are to be fitted with three cameras,	

		Two way communication and MNVR compliant as per AIS-153, with a warranty of five years. k) Provisions be made for fitment of speakers for announcing next stop announcement system. l) The original wiring be bundled and bound by a tape and it should be properly secured in PVC flexible pipe to the rigid portion of the body / chassis with ties/clamps. m) The battery cable joining the starter to the batteries should be with main cable cut–off switch (Isolation switch). Main cable cut-off switch (Isolation switch) be mounted at the side of the Driver's seat frame for easy operation. n) Good quality rectangular body lamps of amber colour indicators 5 Nos at LH side and 5 Nos. at RH side be provided at skirt. Door lamps of red colour be provided at outside and inside the passenger doors to indicate the opening/ closing status of the doors. o) Near priority seats on stanchion pole stop request switches be provided which alerts the driver that a mobility aid user wishes to disembark. Controls shall be mounted not higher than 1300mm. p) Vehicle Location Tracking unit (VLT) and emergency button confirming to AIS-140 be provided. q) The bus should be provided with lighting arrangement as follows: <u>LED Roof lamps for interior Roof:</u> For the full length of saloon area interior roof lamps of good quality and attractive LED roof lamps having output wattage of 2.5W to 10W, the illumination of roof lamps shall be as per AIS 052, at any seating place of the bus. Natural white /	

		Cool white colour should be provided in the passenger saloon. One more LED roof lamp of same as that of saloon light be provided in the Driver's cabin above the Bonnet Assembly. Four numbers of high marker indicators with suitable be embedded on the roof.	
34	SWITCH BOARD:	All the electric switches be of highly reliable latest type. Two main control switches be provided, one for saloon lamps and other for head lights, tail lights, number plate lights. The switches be provided near to the Driver for easy operation.	
35	WIPER ASSEMBLY:	Heavy duty 24 volts Doga make or equivalent electric wiper assembly of reputed make with Wiper Arms & Blades of suitable length as per AIS 011, be provided and mounted at below front glass. The unit be provided at a convenient place for easy maintenance. The specifications of the wiper assembly is enclosed.	
36	NUMBER PLATE:	The number plate be of High Security Registration plate as per Government rules be provided.	
37	Guard rails	Two rows of MS ERW GI pipe guard rails of dia 19 OD x 1.60mm thickness black powder coated be provided. The first be provided at a height of 75mm from the lower window sill and the distance between the oWther guardrail be 75 to 100mm	
38	ELECTRIC HORN:	Two standard good quality Electrical Horn supplied along with the chassis be retained.	
39	STICKERING	Lettering, Monogram, brand etc. be done by using good quality reflecting stickers as per choice and design of BMTC. One set of blue signage stickers be provided in the saloon portion mentioning seats for ladies, physically challenged ladies, physically challenged men, senior citizen , emergency door, no smoking and red colour cross mark for door glass. Radium stickers with BMTC monogram be provided on either side of the vehicle and on the rear side as BMTC in Kannada, BMTC sign be provided on front grill, all the	

		letterings shall be in Kannada, type, size and colour and location as per BMTC requirements. One chart showing the chassis details be screen printed below waist rail by the side of front door.	
40 A	ACCESSORIES	a) One number First Aid Box with lid be provided with lettering and Red cross mark sticker. The box should contain first aid medicines. The lid be provided with hasp and staple. b) One suggestion box be fitted at a convenient position on the Driver's partition and with lettering in Kannada. The lid be provided with letter slot. c) One emission certificate frame of 10" x 17" covered with acrylic sheet of 1/16" thickness in the front and back with card board as that of Photo frame be provided. d) Three Nos. dry powder type fire extinguisher of 6 + 2 + 2 Kgs/6+4kgs totaling to 10 kgs capacity conforming to IS:2171:1985 (tested for 30 kgf/cm2) be fitted with holding bracket. e) Good quality rectangular wider convex rear view mirror for maximum view be provided with suitable mounting foldable adjustable type brackets on either side supplied along with the chassis. Interior rear view mirror be provided in the driver cabin for the visibility of passengers boarding / alighting by the driver as per AIS-052. f) Grip handle of 250mm be provided at driver door pillar from outside. g) 2 nos. of decorative grip handles of 200mm be fitted below front windshield glass. h) In the saloon portion sufficient nos. of good quality plastic triangular type hand grips with nylon belt be provided in between the station poles.	

41	Roof Ventilators/ hatches	Two numbers of roof air ventilators be provided as shown in the drawing. The air ventilators should have cut-out of minimum size 24” x 24” and lid be fabricated with Aluminium sheet. The ventilator be provided with 2 numbers hinges, handles and lifting mechanism for easy operation. The ventilators be made in such a way that it can be used for emergency also. The ventilator be made leak proof.	
42	GENERAL:	a) Clear Window glasses, colours, interior paneling materials, flooring materials, passenger seat assembly, Painting shade & make, Powder coating colour etc., be got approved by CME before taking up the work. b) Inside portions of bonnet, dash board, pneumatic door assembly box, be applied with Silver gray Hammertone type paint. c) Complete under chassis be painted with polyurethane anti-corrosive black paint. d) Proper precaution be taken to avoid damages to any original equipment / assemblies of the chassis while Bus Body fabrication. e) The Body builder should check the Radiator coolant level, Battery charging condition, Engine oil level, Power steering oil level, Gear box oil level and Differential oil level. f) Care should be taken to re-connect all the assemblies disconnected during fabrication. g) Tyre inflation should be maintained. h) Modification/Deviations suggested by BMTC authorized inspecting officials during inspection of Proto type vehicle be incorporated and carried out. i) The documents pertaining to the procurement of materials to the required specification should be produced at the time of inspection. A copy of the seating layout drawing should be given	

		along with vehicle. j) Before the delivery of the completed Bus, the body should be shower tested for roof and sides water leakages and vehicle be taken for Road Test. k) The completed Bus Body be delivered to the receiving end in TIP-TOP good condition after thoroughly cleaning the Bus body including under chassis. l) During bus body building the removed items be returned along with the vehicle.	

D) <u>Electronic based L.E.D Destination Display Boards along with next stop voice announcing system having GPS based receiver / antenna and speakers</u>:

1) L.E.D Destination Display Boards and Voice Announcement System should be provided as per IS 16490: 2016 (reaffirmed 2020) and as amended from time to time.
2) L.E.D Destination Display Boards and Voice Announcement Systems should support English and regional languages and translation should be error free.
3) Words displayed in L.E.D Destination Display Boards should be proper & clearly visible during Day & Night and in all weathers.
4) Suitable device be provided for loading data into route controller for every 25 buses supplied to BMTC.
5) Route Controller shall have built- in memory storage capacity of minimum 64 MB, and shall be capable of controlling all the L.E.D boards present in the vehicle.
6) Voice Controller should have built in memory storage of minimum 1 GB and volume with noise free integrated voice announcement system. Speakers provided should be capable of announcing destination/ bus stop names clearly.
7) Both the controllers should support support for programming of minimum 150 numbers of Routes (alpha numeric characters) and 300

no.s of destinations. Further the system shall also have a programming of minimum 50 no.s of bus stops on each route.

8) **Controller Cabinet**: Rugged construction with Aluminum or steel and Powder Coated. Cabinet shall be water, dust and ingress proof and also withstand noise & vehicle Vibration.

9) **Display Size:**

Front Display : size: Min. width: 1800mm, Min. Height: 220mm, Min. Character Height: 200mm
Side display : size: Min. width: 900mm, Min. Height: 220mm, Min. Character Height: 200mm
Rear display : size: Min. width: 900mm, Min. Height: 220mm. Min. Character Height: 200mm
Internal display: size: Min. width: 800mm, Min. Height: 100mm. Min. Character Height: 100mm

10) **DIMENSIONS:**

The dimensions for LED Display system to be fitted on vehicles are as given below:

Sr. No.	Description	Board size (min)		Character Height (min)	LED Pitch (Max)
		Width	Height		
6.1	Front display	1800mm	220mm	200mm	H13.4xV14.1 mm
6.2	Side display	900mm	220mm	200mm	H13.4xV14.1 mm
6.3	Rear display	900mm	220mm	200mm	H13.4xV14.1 mm
6.4	Internal display	800mm	100mm	100mm	-----

11) **Data Transfer**:

Route Controller and Voice Controller should be provided with suitable USB ports Provisions for upgrading/ modifying the existing information as well as additions and deletions. Windows based editor software should be provided for Programming Routes. All information pre-programmable and loaded on to the controller through PC. Ability to retain the entire data in memory in the event of power failure and any other kind of failure in the system be provided.

12) **Penalty:** As the Non-functioning of L.E.D destination boards and Voice Announcement System is leading to complaints by public, media and also filing of cases at court, hence the non-functioning L.E.D destination boards and Voice Announcement System should be

made properly functional within 48 hrs of complaint reported through email/ letters. If failed to make the L.E.D destination boards and Voice Announcement System functional, an amount of Rs. 500/- will be imposed as a penalty per vehicle for every non-functioned day.

E) Specification for Seat assemblies for City type buses

Sl. No	Item	Description
1	MAIN FRAME	Should be of 25 mm Sq. x 2 mm thick M.S.ERW Tubes, (30 x 20 x 1.6) mm thick rectangular tubes, (25 OD x 2) mm thick tube, (180 x 75 x 4) mm thick MS Gussets used for seat structure at bent portion. The frame should be joined with MS ERW Square tube of size (19x19x2) mm on top and bottom to support the backrest assembly. There shall be a provision of MS pressed "Z" section of size of minimum (15x12x10x2) mm on both sides to guide 2mm thick Polypropylene sheet and plywood of 4mm thick.
2	MOUNTING LEG	Should be of (25 OD x 2.5) mm thick & (19 OD x 2) mm thick M.S.ERW Tubes and 6mm thick M.S. Plates and Gussets of size (35 x 35 x 4) mm thick. The tubes / M.S. components are to be MIG welded together to give sufficient rigidity and strength.
3	SEAT BASE SUPPORT	The seat base support should be made of 12 mm thickness Plywood of MR Grade as per IS 303 / 1989 of reputed make. Bottom side of the Plywood should be applied with wood primer.
4	BACKREST SUPPORT	The Backrest frame should have a support made of tube (19 OD x 2) mm thick with 4mm dia support rods 4 Nos. and suitable mounting to the main frame. The Backrest cushion glued / in-situ moulded to the backrest frame assembly.
5.	BRACKET FOR MOUNTING SAFETY BELT	The bracket of 4mm thickness should be fabricated as per the enclosed drawing and the material shall conform to IS 1079-D class. The brackets should be welded to seat frame assemblies as indicated in the enclosed drawings.
6	FIXED ARMREST "OPTIONAL"	Integral skin moulded PU Foam Pad Black in colour fitted on (19 OD x 2) mm thick MS ERW Tube.
7	CUSHION ASSEMBLY	Ergonomically contoured Moulded Polyurethane, of CFC (Chloro-fluro carbon) free, fire retardant with optimum hardness and bucket shape with sufficient relief & recess be provided at the bottom of size 60mm wide x 40mm depth with sufficient rib provided at the bottom to support for optimum comfort as per enclosed drawing. a)Individual Bottom cushion size: (400 x 435 x 120) mm front x 65 mm at rear. b)Individual Backrest with integral headrest Cushion

		Foam in-situ moulded backrest frame.(Sl.No.4) Size: (397 x 665 x 40) mm at center Sides (80 x 94 x 40 x 85) mm as shown in drawing c) Hardness: Test method as per ISO 2439 / 1980 Clause No.7, Method-A i) Seat base: 17 – 23 Kgf on seat foam ii) Backrest: 11 – 17 Kgf on backrest foam. d) Elongation Gap : 80% minimum. e) Resilience : 40 – 60% f) Density : 45 – 55 Kg./Cu.Mtr. g) Compression Set test : 13% (max.) h) Flammability Test : Should conform to all applicable clauses of IS: 15061:2002. i) Tensile strength : 0.65 Kg/Sq.cm. Minimum
8	UPHOLSTERY	The cushions should be upholstered with PVC cloth (Rexine) as per IS:1259 Grade 1, Class'A' and Woven Satin Fabric backup of reputed make of good quality. Seat base cushion Upholstery be fastened with staple pins and backrest upholstery be fastened with hog ring assembly. The headrest portion be provided with Headrest cover with the same Rexine cloth.
9	BACK COVER	The Back cover be made of 2 mm thick Poly - Propylene sheet of in black colour with 4mm thickness plywood of MR grade IS: 303- 1989.
10	OVERALL DIMENSIONS	As per enclosed drawing.
11	STRUCTURE	The materials be used for construction of frame structure conforming to IS standards: MS Tubular components to ERW 1 un-annealed as per IS: 3074 / IS: 4923 and MS Metal components to IS: 513 / IS: 1079, O & D Classes. All metal parts exposed to air are to be Phosphated and Black Powder coated to give a dry film thickness of minimum 40 microns.
12	TOTAL WEIGHT	The total weight of complete assembly shall be: a) Two Seater assembly : 21.50 Kg b) Three Seater assembly: 29.50 Kg c) Single Seater assembly: 14.00 K With a Tolerance of +/- 2.5 Kgs
13	GENERAL	i)The materials used should conform to all applicable clauses of IS: 15061:2002 for flammability requirements. ii) Approved quality & design of Rexine Cloth should be used. iii) Advanced trim fastening be adopted to retain cushion contours. iv) Design for easy serviceability. v) A warranty period of 2.50 Lakh Kms. OR 36 Months, whichever is later from the date of commission of the

		Bus.

(A) The PU Cushions should be as per ASRTU Specification No**.**AS:329:70:FEB:2006.

Sample cushion of the following sizes should be submitted along with the Tender for testing. The samples should be tested as per IS 7888-1976 reaffirmed 1991, ISO 2439 / 1980 Clause No.7, Method-A and ISO 3795/1976(E), IS 15061:2002.

Sl. No.	Test	Sample size	No. of pieces
1	Indentation Hardness	380x380x50mm (Back rest) & 380x380x75mm (Seat cushion)	3 3
2	Density	100 x100 x 50mm	3
3	Tensile Strength & % Elongation	152 x 38 x 20mm	5
4	Resistance to temperature	152 x38 x 20mm	5
5	Compression Set	50 x 50 x 25mm	3
6	Shear fatigue	380x380x50mm	3
7	Flammability	150 x150 x 50mm	5

(B) The PVC cloth (Rexine) should be as per ASRTU Specification No.AS:208:59:July:99, IS 1259/1984 (Reaffirmed 1991) supplied in Grade-1, Class 'A' and woven satin fabric backup of reputed make. The PVC cloth (Rexine) sample of 5 Mtr. length should be submitted along with the tender for testing. The sample would be tested as per the specification. The test specimen shall be conditioned in an atmosphere with relative humidity of 65+/- 5 percent and temperature of 27 +/- 2˚C for 16 hours.

Sl. No	Test Parameter	Requirements
1.	Mass of finished fabric, g/sq.m	680
2.	Breaking strength in kg/5 cm width, min a. Longitudinal direction b. Transverse direction	 90 100
3.	Resistance to damage by flexing (number of cycles in thousands), min a. First stage b. Second stage	 200 300
4.	Resistance to heat a. loss of mass b. Exudation or stickiness	 Shall not be more than 4% No sign
5.	Resistance to cold	No cracks
6.	Colour fastness to dry and wet rubbing	No stains

7.	Flame Resistance	As per IS:1259 & IS:15061
8	Adhesion of coating	Shall not separate more than 10 mm
9.	Dimensional change	Shall not be more than 3 % in either direction.
10.	Coating	Suitable compound applied uniformly
11.	Bleeding test	No change in original shade
12.	Surface resistance to chemicals	No change in original shade/tackiness
13.	Water proofness test	No water globules/patches

F) Specifications for U Bolts with Nylon lock nuts for bus bodies

1) Application: The specification covers the requirement of U Bolts and Nylon nuts used for bus body application.
2) Reference Standard : IS: 1367 :1991 – Part-III

   IS : 1367 : 1992- Part VIII
3) Dimensions: 16mm (5/8”) diameter rod is to be used. The shape, total length, threads length, type of threads and pitch is to be provided as per the drawings. The U bolts are to be Zinc plated and it should be 10-20 microns thick.
4) Material : A suitable material which should give Mechanical properties to grade 8.8- IS: 1367: 1991- Part III
5) Visual Examination: It should be free from all visual defects such as cracks, unevenness on the sets and other irregularities which may affects its life.
6) Mechanical properties
   a) Tensile strength : 80Kg /Sq.mm (min)
   b) Percentage Elongation : 12 (min)
   c) Hardness : 242 – 318 BHN
   d) Impact strength : 30 Joules (min)
   e) Depth of de-carburization 0.015mm (max)
7) Threads : Shall be rolled threads of 5/8 “ BSW 11 TPI
8) Nuts : Each U bolt is to be provided with 2 nos. of prevailing torque type hexagonal self locking nuts of class 8 (P8) with non-metallic insert of thread size 5/8”BSW 11 TPI (IS: 1367:1992 Part VIII) zinc plated. The nut across flat size should be 1”(25.4mm) and height of the nut 7/8”(22mm) of heavy duty type including Nylock insert.
9) Size of U bolts : As per drawings

Leyland – 1) 11 ¾ “ x 3 ½ “ x 5/8 “ (298 x 89x 16mm)
2) 11 ¾ “ x 5 “ x 5/8 “ (298 x 127x 16mm)
Tata – 1) 10 ¾ “ x 3 “ x 5/8 “ (273 x 76x 16mm)
2) 10 ¾ “ x 4 ½ “ x 5/8 “ (273 x 114 x 16mm)
3) 11 ¾ “ x 4 ½ “ x 5/8 “ (273 x 114 x 16mm)

Note : According to the chassis frame web height U bolt be provided.

G) Vehicle Location tracking (Automatic Tracking Device) and Emergency Button Specifications:

The Automatic Tracking Device (ATD) and Emergency Buttons should be fully compliant to AIS-140 standard (as amended from time to time) and should be type approved from testing agencies authorized under CMVR.

In addition to above, the ATD should meet the following requirements:

i. The ATD shall provide the output as per NMEA0183 for GPRMC packets to PIS controller through RS232 at minimum frequency of 1 Hz.
ii. ATD should support Over the Air (OTA) firmware and configurational parameter updation.
iii. ATD should send device health monitoring parameters.
iv. ATD should send location data @ 10 seconds during bus ignition on and @1 minutes when bus ignition off.
v. ATD should have inbuilt battery with a backup of at-least one hour
vi. ATD should come with normal SIM slot with single carrier communication/ e-SIM. The data communication from the ATD with all incidents and video feed should be precisely on server/cloud provided by BMTC.

On pressing of any of emergency button the emergency alert should be sent to the configured IP address. In the absence of GPRS network, the alert should be sent as SMS.

H) <u>Cameras and MNVR:</u>

The buses are to be fitted with three cameras and MNVR with a warranty of five years and the specifications are as under:

(i) In- bus Camera

Sl no	Parameter	Minimum Specifications
1	No of cameras	3
2	Power Supply	PoE through MNVR, should be automatically switched on with engine and power down on ignition off.
3	Camera feed display	Relay feed to control center on demand. Web viewer, cloud enabled CMS(DSS/Smart PSS) & DMSS
4	Camera recording duration	To be provided in MNVR
5	Fixed lens	3.6 mm
6	Picture Resolution	752 H x 582 V (PAL)
7	Resolution	25/30fps@1080P
8	Picture Sensor	1/3” 2 Megapixel progressive scan Aptina CMOS,
9	IR distance	Min 30 m
10	Image Enhancement	DWDR, Day/Night(ICR), 3DNR,AWB,AGC,BLC
11	Video and Audio Compression	The IP camera shall support H.254 video compression and G.711 or G.726 audio compression
12	Protection	Minimum IP 66
13	IP Camera	Yes
14	Temperature	-10 deg C to + 60 deg C
15	Humidity	5% to 95 %
16	Vibrations	10g
17	Motion detection	Automatic
18	Camera Ruggedness	Rugged, vibration, shock and tamper proof Metal housing, Aviation Connectors Installation :Anti Vibration with Adjust Angle; Ø Horizontal: 0~355 degree with 3-point locking Ø Vertical:0~90 degree with 2-point locking

(ii) Technical Specifications - MNVR

Sl No	Parameter	Minimum Technical Specifications
1	Video Format	752 H x 582 V (PAL)
2	Number of Video Inputs	4 channels

Sl No	Parameter	Minimum Technical Specifications
3	Number of Video Outputs	1 suitable
4	Number of Audio Inputs	4channels
5	Number of Audio Outputs	1
6	Video Compression Standards Supported	H.265+/ H.265, H.264, H.264+, MPEG-4, M-JPEG, Dual stream encoding
7	Audio Compression Standards Supported	At least any one of G.711, G.726
8	Number of streams	Dual streams, both streams independently configurable for each camera resolution and frame rate
9	Recording Resolutions	HD (720p/1080p)/WD1/4CIF/2CIF/CIF/QCIF(can be set independently for each channel, for both streams)
10	Video Frame Recording Rate	a) 1 to15 fps for all channels atHD(total 60 fps). b) 1 to25 fps for all channels at 4CIF (total 100 fps). c) resolution and frame rate can be set independently for each camera, for both streams
11	Alarm Sensors	Minimum 8inputs(NO/NC, configurable) 2 outputs
12	Storage	a) 1 TB, 2.5” SATA Solid State Drive with suitable ant-vibration mechanism. b) Minimum 15 days of on-board storage. c) Solid State Disk to be pluggable and easily removable, secure and protected by lock. d) mNVR should have storage capacity for at least 15days
13	Recording Modes	Normal, Schedule based, Alarm (via I/0 input e.g. Emergency Button, Emergency Door Open, Brake On, Reversing) triggered, Motion detection, Video loss, Camera Cover, Vehicle Speed, Threshold exceed on 6 axis Gyro, Recording On – Green mark, ‘Event’ Recording –Red mark

Sl No	Parameter	Minimum Technical Specifications
14	Transmission and Remote Monitoring of 'Video surveillance' data	Transmit over 4G and above, log on Server and Remote monitoring (Server/Client &iOS, Android Mobile Terminal) along with GPS Location on map. (see example under GPS requirements) Transmission Settings: Always On, SMS/Telephone Snap shot at configurable frequency Alarm (via I/0 input e.g. Emergency Button, Emergency Door Open,) Snap shot Estimated data/ Camera WD1, Quality 1=65KB CIF, Quality 4= 9KB
15	Event Based Recording And Tagging	Pre-recording–1to60 minutes Post-recording–1to30 minutes In case of events/recordings and tagging to be made available
16	Shut Down Delay	Configurable shutdown delay after ignition off up to 24 Hours
17	Power Input	9 to 32 volts
18	Power output	Regulated power to CCTVcameras and Microphones and all other equipment used In the System
19	Working Temperature	-10 to 60 degree Celsius
20	Working Humidity	0% to 95% relative humidity
21	Network/Communication	LAN – 1 RJ45 interface 4 ports PoE (IEEE802.3af/at)/M12 connector Wi-Fi – 802.11/b/g/n
22	Interfaces	Wi-Fi–802.11/b/g/n 2.4 GHZ Access Point - 10M for Data Download and System maintenance. Details as per Clause 5 Built-in3Gmodule, supportingboth2G and 3G (at least900,1800and2100MHzfrequency bands), Support for SMS, Voice, Data, GPRS, TCP/IP-External Antenna Built –in

Sl No	Parameter	Minimum Technical Specifications
		GPS Module-External Antenna
23	External Interfaces	1RS232, 1USB2.0, 1 Channel Pulse Speed Detection 1 SIM slot (Capable ofusingM2M Plastic, M2M RobustPlasticSIMandM2MIndustrialSIM) – To be mounted in a Lockable Compartment
24	Image quality	1 to 8 (configurable) In case of following Quality will automatically upgrade to 1(configurable): Alarm (via I/0 input e.g. Emergency Button, Emergency Door Open, Brake On, Reversing) triggered, Motion detection, Video loss, Camera Cover, Vehicle Speed, Threshold exceed on 6 axis Gyro
25	Watermark	Tamper-proof Watermark
26	Configurable Video Overwriting	Video over-writing to be configurable to support: Cyclic overwriting (oldest recording to be overwritten) Configurable days/Capacity/never Event tagged recording not to be overwritten for a longer period (7 to 30days, configurable)
27	Connections	All input and output connections to be vibration/shock Resistant and locking. Desirable: Aviation Connectors
28	Installation	360 deg mounting position
29	LED Indicators	Power, Recording, 4G/ GPRS Network, Recording Error, Alarm, USB
30	IP Rating	Minimum IP53 with necessary ingress protection for antivibration on In Bus Environment
31	Test Compliances	As Detailed later in this document
32	Health Parameters over 4G & above SMS	Capable of sending health parameters (cameras not functioning, cameras

Sl No	Parameter	Minimum Technical Specifications
		tamper, SSD error, HDD/SSD full) at specified frequency to the server Capable of detecting failure, error or tamper of cameras or any component (Network Disconnected, IP Address Conflict, Illegal Login), Alarm (via I/0 input e.g. Emergency Button, Emergency Door Open) triggered, Video loss, Camera Cover, No SD Card, No Recording, Vehicle Speed, Vehicle acceleration (SDS) ‘ Camera cover’-sensitivity is configurable –common to all Camera and sending alert to severe mail and SMS to preconfigured contacts.
34	Over-the-airUpdate/ Upgrade	Over-the-air update of configuration parameters of MNVR and cameras. Over-the-air upgrade of firmware The OTA updates will be based on Supplier Protocols
35	Video Detection	Motion Detection, Video Loss & Camera Blank
36	RTC	Built-in RTC, drift not more than 10 seconds at any Time
37	Data Download and Configuration settings	MNVR should provide video and audio download facility for the desired date/time and duration. It should be possible to connect a laptop to MNVR through network cable on RJ45 port and open MNVR user interface in a standard browser using a standard URL such as http://nvr (or any other text specified by MoRTH) without having to configure the lap-top’s network settings. After entering user-id and password (specified by MoRTH), it will be possible to search, view, select and download video clips of desired duration and date/time in standard formats such as .avi or .mpg. It will not be possible to delete any video or change configuration

Sl No	Parameter	Minimum Technical Specifications
		settings using this set of user-ID and password. Also, the data shall also be downloaded through remote login.
38	Data Transfer on 4G & above	In case the vehicle moves to an area where 4G & above coverage is not present, the mNVR will automatically shift to GPRS (2G) connectivity to send the health status data. Also, in such case, on press of an emergency button, the mNVR will automatically shift to a lower frame rate and resolution (both configurable) and send the video from cameras to the backend server over GPRS (2G).
39	Integrated Applications / Software to be Supplied along with Equipment and all Protocol will be proprietary	Playback of Record on Storage Media Server/Client – 'Windows server 2012 R2 Standard' & iOS, Android Mobile Terminal Export of Server Log User and Evidence Management
40	ONVIF	ONVIF S & G Profile Compliant
41	Certification	UL, CE, FCC, EN50155, BIS,EN 61000, AIS004,IS16833
42	Open platform	The system should be open platform and not proprietary solution, it should have integration with at least 50 leading IP camera brands of the world (List of IP camera to be attached)
43	Analytics	Camera tampering Trigger based recording form Panic Button
44	Panic button assistance	In the event of usage of panic button, mNVR shall share all in bus camera footages of total 60seconds over 4G and above to control centre. (60seconds = 30seconds before the pressing of button and 30seconds after the pressing of button)

iii) Performance and Durability Testing & Environmental Test

Test Compliances for mNVR + Camera + GPS + Panic/SOS Button (together):

Verification Report of ARAI/ ICAT/ CIRT is mandatory.

iv) ITS integration :

1) The Service provider shall maintain their own server from which the data shall be pushed to BMTC ITS application through Application Programming Interface (API). Further, all necessary software's required for integration shall be maintained by the service provider.
2) Real time GPS data, through Application Programming Interface(API) (Push) Protocol.
3) Panic/ SOS button when pressed, alert should go to BMTC servers and also 30 seconds video before and after panic/ SOS button press should be sent to BMTC server through API (Push) Protocol.
4) Availability of live streaming of video through API (Push) to integrate with BMTC application.
5) Manual video download option to be available through API (Push).
6) 4G & above SIM card for both ATD and mNVR to be provided by vendor along with data plan [ATD device (4G & above)-500 MB minimum per month and for mNVR (4G & above)-2 GB minimum per month]
7) Appointing one nodal person from vendor to co-ordinate with BMTC security department and police department to share mNVR camera footage when sought for.
8) Provide access to the data or fails to integrate with the BMTC ITS/AVLS shall be done within 45 days of commissioning of fleet. **Penalty** of Rs.750 per bus per week will be levied for failure.
9) If any partial data/no data/ delayed data / in accurate data is received from the devices, though the trip is operated

completely, **Penalty** of Rs.500 per bus per week will be levied.

10) Hardware Specification of ATD, mNVR & Camera's to be installed in bus is provided in the above table.

I) Specifications of wiper motor

WIPER SYSTEM SPECIFICATION DETAILS:-

1) 24V Heavy duty wiper motor – 1 No.
2) Wiper blade 1000 mm for driver side and Co-driver side – 2 Nos.
3) Transmission linkage assembly – 1 No.
4) 3 L Water bottle – 1 No.
5) Wire loom with 60 amps relay for low speed, 60 amps relay for high speed, 60 amps relay for intermediate speed, over heat sensor, thermal cut off sensor and Jog dial switch for all 3 speeds.

WIPER MOTOR:-

- Torque: 130-140nm
- Voltage: 24V
- Speed: 2 SPEED
- Drive shaft be straight, major dia: 13.25mm, minor dia:12.90, 60 serrations, Angle 90 degree pitch 6mm.,
- Yoke : 4 magnets
- Casting Facia : 90 PCD
- Internal Gear : Delrin P100 raw material
- INTERNAL GEAR: DELRIN P100 RAW MATERIAL
- RPM : No load High speed 45/ Min and No load Low speed 30 /Min, difference should be 15 cycles minimum.

WIRING HARNESS COLOUR CODE AS PER AIS 052:-

- Low speed=black
- High speed= GREEN & RED
- Parking = White
- Positive=PINK
- Negative=Brown
- THERMAL CUT OUT MANDATORY + CAPACITOR MANDATORY

WIPER BLADE:-

- Composition – Synthetic blend
- Should resist 50% solution of either Methyl or Isopropyl alcohol for a period of 24 hrs.
- To meet ozone resistance and chemical resistance test as per Annexure- IV of AIS : 019
- Length: DRIVER SIDE 1000mm & CO-DRIVER SIDE 1000mm

WIPER ARM:-

ELIPTICAL TUBULAR SERIES:

- 21mm CRC pipe elliptical profile high strength grade of 1.20mm thick
- Spring retainer to be grade II with 60% carbon
- Arm base be of 2.00 mm thick
- Holding block width be of 40 mm
- Nozzle mounted should be 4 way with nozzle taper 60°
- Holding block dust cover raw material in Derlin

WIPER TRANSMISSION LINKAGE ASSY:-

- Total length from driver pivot holding up to Co-driver pivot housing-1785mm
- Pivot housing length – 135mm
- Pivot shaft M12 – 160mm
- Pivot housing nut – 36mm
- Channel section – 2.50mm
- Center pivot housing – 76mm
- Driver side center distance up to motor – 840, Motor mounting center distance up to clutch assembly - 530
- Clutch assembly CD up to Co-driver pivot housing – 945

WASHER BOTTLE:-

- CAPACITY: 3L
- BLOW MOULDED ONLY
- LEAKAGE TO BE TESTED AT 30psi
- CAP SHOULD BE IN YELLOW/BLUE COLOUR ONLY

WASHER BOTTLE ASSY:-

- CAPACITY: 3L
- 24V DC MICRO PUMP
- DC FERRITE MAGNET TYPE
- POWER CONSUMPTION: 3.5amps OR LESS
- NOZZLE JET: 70(12.8) OR MORE

WASHER ACCESSORIES:-

- 7 METERS EPDM WITH ‘T’ JOINT+UMBRELLA JACK

WIRE LOOM:-

- 60AMP RELAY FOR LOW SPEED
- 60AMP RELAY FOR HIGH SPEED
- 60AMP RELAY FOR INTERMEDIATE SPEED
- OVER HEAT SENSOR+ANTI BREAKING TORQUE SENSOR
- CURRENT BREAKER CIRCUIT+PCB BOARD
- 5 PIN PIG TAIL CONNECTOR MANDATORY

Chief Mechanical Engineer